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ABSTRACT

Two prototypes to categories of necessary workforce skills in five studies are related: (1) "What Work Requires of Schools" by the Secretary's Commission of Achieving Necessary Skills (SCANS); (2) "Workplace Basics: The Essential Skills Employers Want" by the American Society of Training and Development (ASTD); (3) "Michigan Employability Skills Employer Survey" by the Michigan Employability Skills Task Force (MESTF); (4) "Basic and Expanded Basic Skills" by the New York State Education Department; and (5) "High Schools and the Changing Workplace: The Employers' View" by the National Academy of Sciences (NAS). The SCANS found five competencies (resources, interpersonal skills, information, systems, and technology) based on basic skills, thinking skills, and personal qualities. The ASTD identified 16 skills within 7 skill groups (foundation, basic competency skills, communication skills, adaptability skills, developmental skills, group effectiveness skills, and influencing skills). The MESTF identified 26 skills with 86 subskills in 3 domains of academic, personal management, and teamwork skills. In New York, two categories of basic skills (language arts and mathematics) and eight expanded basic skills were found. The NAS found 10 core competencies. Four job readiness skills categories run through the five frameworks. All studies identified the need for higher order thinking skills and judged interpersonal and teamwork skills as essential. Problem solving and conflict resolution prototypes; and the relationship of problem solving skills to SCANS, ASTD, MESTF, New York, and NAS skills are considered. Included are 20 tables and 3 appendices providing basic skills definitions, interpersonal skill level examples, and validation results. (RLC)

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CSE Technical Report 343

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MEASUREMENT OF WORKFORCE READINESS: REVIEW OF THEORETICAL FRAMEWORKS

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The Cognitive Science Laboratory of USC, subcontracting with the Center for Research on Evaluation, Standards, and Student Testing (CRESST) at UCLA, has been working to develop the needed assessment measures of identified workforce readiness skills. A general methodology approach for measurement of workforce readiness competencies has been developed. Additionally, this methodology has been applied to develop two prototype test items, one for the measurement of problem-solving skills and one for the interpersonal skills involved in conflict resolution.

The prototype items and their development in the context of the Secretary's Commission on Achieving Necessary Skills (SCANS) are discussed in detail in another report (O'Neil, Allred, & Baker, 1992). The purpose of this report (Deliverable 2 on our USC subcontract) is to show the generality of our approach by relating the two prototypes to the categories of necessary workforce skills identified in five major studies. The five studies examined are: (a) *What Work Requires of Schools* conducted by the Secretary's Commission of Achieving Necessary Skills (SCANS) for the U.S. Department of Labor (SCANS, 1991); (b) *Workplace Basics: The Essential Skills Employers Want* conducted by the American Society of Training and Development (ASTD) with the support of the Department of Labor (Carnevale, Gainer, & Meltzer, 1990); (c) *Michigan Employability Skills Employer Survey* conducted by the Michigan Employability Skills Task Force (Mehrens, 1989); (d) *Basic and Expanded Basic Skills* conducted by the New York State Education Department (1990); and (e) *High Schools and the Changing Workplace: The Employers' View* conducted by the National Academy of Sciences (NAS, 1984).

These studies have their source in a common concern. Current economic difficulties and the challenge of competing in the world market have necessitated a rethinking of American approaches to the utilization of people in organizations. The early part of this century witnessed a burgeoning concern about how to organize the efforts of individuals in the large organizations that resulted from the industrial revolution. Previously, productivity was regarded as a function of technology and access to raw materials. Increasingly, however, the human factor came to be recognized as critical to productivity. Frederick W. Taylor (1916), considered the father of the field of American management, recognized the limitations in skills of most workers in these organizations. His answer to the deficiency in worker skills was to emphasize the need for an extensive managerial structure to organize and supervise the workers, leaving as little responsibility and discretion as possible to the common worker. Although it remained dominant in the American workforce for decades, this emphasis has been fundamentally rethought in the last decade, and especially in the last several years.

In contrast to the traditional approach in the United States, management now recognizes a need to have workers take on more responsibility at the points of production, of sales, or of service rendered, if we are to compete in rapidly changing world markets. In order to adapt to the need to introduce new products and services quickly with high quality, new directions in management emphasize participative management, flatter organizational structure, just-in-time management, and team work. This development means that much more is expected of even entry-level members of the American workforce. The cry of American management for workers with greater skills and who can take on greater responsibility has spawned many commissions, task forces and studies, including the five studies mentioned above (see Table 1 for examples). All of them have contributed to the vast evidence documenting the need for a more highly skilled workforce. What remains largely undone is the development of methods to assess the necessary skills that have been identified.

Table 1

Reports Documenting the Need for Job-Readiness Skills

America's Choice: High Skills or Low Wages! National Center on Education and the Economy, June 1990
Basic and Expanded Basic Skills. New York State Education Department, July 1990
Jobs. A Michigan Employability Profile (April 1988) and *Employability Skills Task Force Progress Report* (November 1989). Employability Skills Task Force, Lansing, MI, Office of the Governor
Michigan Employability Skills Employer Survey. Technical Report. Mehrens, Lansing, MI, Michigan State University, November 1989
High Schools and the Changing Workplace: The Employers' View. National Academy of Sciences (NAS), 1984
What Work Requires of Schools. Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, June 1991
Workplace Basics: The Essential Skills Employers Want. Carnevale, Gainer, & Meltzer, San Francisco, Jossey-Bass, 1990

In general, the five studies examined in this report all began with a similar first step. Experts, generally educators, business people, scholars, and policymakers, were assembled to identify skills necessary for the workforce. The experts generated a framework of skills based on their own knowledge and experience, in addition to various informal investigations of the workforce and its requirements. All but the NAS study also included a second, validation phase. In this phase, employers and/or employees were asked how necessary each of the identified skills is.

The five frameworks of skills which these studies identified will first be reviewed individually. Subsequently, the frameworks will be compared and summarized. Finally, the two prototype measures developed by CRESST/USC will be related to the findings common to the five studies and to each of the frameworks individually.

SCANS

SCANS was charged by the U.S. Secretary of Labor to investigate what is required in today's and tomorrow's workplace and to determine the extent to which high school students are able to meet those requirements. Specifically, SCANS was directed by the Secretary of Labor to (a) define the skills needed for employment, (b) propose acceptable levels of proficiency, (c) suggest effective ways to assess proficiency, and (d) develop a dissemination strategy for the nation's schools, businesses, and homes. In June 1991, the Commission issued a report (SCANS, 1991) concerning the first two directives. The Commission, based on its discussions and meetings with business owners, public employers, unions, and workers and supervisors in shops, plants, and stores, identified five competencies in accordance with the first directive: the ability to efficiently use (a) resources, (b) interpersonal skills, (c) information, (d) systems, and (e) technology (see Table 2). Additionally, the Commission found that these five competencies are based on a three-part foundation: (a) basic skills, (b) thinking skills, and (c) personal qualities (see Table 3).

Table 2. Five Competencies

Resources: Identifies, organizes, plans, and allocates resources

A. *Time*—Selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules

B. *Money*—Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives

C. *Material and Facilities*—Acquires, stores, allocates, and uses materials or space efficiently

D. *Human Resources*—Assesses skills and distributes work accordingly, evaluates performance and provides feedback

Interpersonal: Works with others

A. *Participates as Member of a Team*—Contributes to group effort

B. *Teaches Others New Skills*

C. *Serves Clients/Customers*—Works to satisfy customers' expectations

D. *Exercises Leadership*—Communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies

E. *Negotiates*—Works toward agreements involving exchange of resources, resolves divergent interests

F. *Works with Diversity*—Works well with men and women from diverse backgrounds

Information: Acquires and uses information

A. *Acquires and Evaluates Information*

B. *Organizes and Maintains Information*

C. *Interprets and Communicates Information*

D. *Uses Computers to Process Information*

Systems: Understands complex inter-relationships

A. *Understands Systems*—Knows how social, organizational, and technological systems work and operates effectively in them

B. *Monitors and Corrects Performance*—Distinguishes trends, predicts impacts on system operations, diagnoses deviations in systems' performance and corrects malfunctions

C. *Improves or Designs Systems*—Suggests modifications to existing systems and develops new or alternative systems to improve performance

Technology: Works with a variety of technologies

A. *Selects Technology*—Chooses procedures, tools or equipment, including computers and related technologies

B. *Applies Technology to Task*—Understands overall intent and proper procedures for setup and operation of equipment

C. *Maintains and Troubleshoots Equipment*—Prevents, identifies, or solves problems with equipment, including computers and other technologies

(SCANS, 1991, p. 12)

Table 3

A Three-Part Foundation

Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks

A. *Reading*—Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules

B. *Writing*—Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts

C. *Arithmetic/Mathematics*—Performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques

D. *Listening*—Receives, attends to, interprets, and responds to verbal messages and other cues

E. *Speaking*—Organizes ideas and communicates orally

Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons

A. *Creative Thinking*—Generates new ideas

B. *Decision Making*—Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative

C. *Problem Solving*—Recognizes problems and devises and implements plan of action

D. *Seeing Things in the Mind's Eye*—Organizes and processes symbols, pictures, graphs, objects, and other information

E. *Knowing How to Learn*—Uses efficient learning techniques to acquire and apply new knowledge and skills

F. *Reasoning*—Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem

Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty

A. *Responsibility*—Exerts a high level of effort and perseveres towards goal attainment

B. *Self-Esteem*—Believes in own self-worth and maintains a positive view of self

C. *Sociability*—Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings

D. *Self-Management*—Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control

E. *Integrity/Honesty*—Chooses ethical courses of action

(SCANS, 1991, p. 16)

ASTD

The American Society for Training and Development (ASTD), a non-profit professional association representing approximately 50,000 practitioners, managers, administrators, educators, and researchers in the field of human resource development, also undertook an extensive study of skills required in America's workforce. Supported by a grant from the Department of Labor, ASTD reviewed relevant research and conducted extensive on-site studies and telephone interviews to find out what employers thought that their workers needed to be successful. Again, the emphasis was on skills that are needed across all jobs. ASTD also consulted with more than 400 experts in interpreting their findings. The result was the identification of the 16 skills within the seven skill groups listed in Table 4 (Carnevale, Gainer, & Meltzer, 1990).

Table 4

ASTD Skills

I.	The Foundation:
	(1) Learning How to Learn
II.	Basic Competency Skills:
	(2) Reading
	(3) Writing
	(4) Computation
III.	Communication Skills:
	(5) Speaking
	(6) Listening
IV.	Adaptability Skills:
	(7) Problem Solving
	(8) Thinking Creatively
V.	Developmental Skills:
	(9) Self-Esteem
	(10) Motivation and Goal Setting
	(11) Career Development (Planning)
VI.	Group Effectiveness Skills:
	(12) Interpersonal Skills
	(13) Teamwork
	(14) Negotiation
VII.	Influencing Skills:
	(15) Understanding Organizational Culture
	(16) Sharing Leadership

Michigan

In 1987, the Employability Skills Task Force was convened by Governor Blanchard's Commission on Jobs and Economic Development to identify the generic skills employers believed to be important in jobs across all sectors of the economy. Composed of leaders from business, education, and labor across the state, the Task Force identified 26 skills falling into the three domains of academic, personal management, and teamwork skills. The skills are presented in Table 5.

These 26 skills were further refined into 86 subskills and then validated through a survey in which over 2,500 Michigan employers rated the importance of the skills identified. In general, all the skills were rated as very important. The average overall rating corresponded to "Highly Needed" on the response scales. However, personal management and teamwork skills were more highly valued than academic skills (Mehrens, 1989).

New York

The New York State Department of Education convened a blue-ribbon committee of educators, scholars, and business people who developed a framework of skills necessary for the workforce. The result, as seen in Table 6, was two categories of Basic Skills—Language Arts and Mathematics—and eight Expanded Basic Skills (see Appendix 1 for definitions).

This framework (Anderson Committee, no date; New York State Education Department, 1990) was subsequently validated in a study in which 1,400 workers in jobs that did not require a college degree were interviewed and observed with regard to what was required of them at work. Based on these interviews and observations, the investigators rated the level of a given skill necessary for that job. The New York study is currently the only one to have examined this critical issue of what *levels* of the skills identified are required in the work force, although SCANS is in the process of addressing this issue. The ratings ranged from 1—the lowest observable adult level of a skill—to 6—representing outstanding performance of that skill.

Table 5

Michigan Skills

Academic Skills	Personal Management Skills	Teamwork Skills
• Understand spoken language and speak in the language in which business is conducted. • Read written materials (including graphs, charts, and displays). • Write in the language in which business is conducted. • Understand and solve problems involving basic arithmetic and use the results. • Use the tools and equipment necessary to get a job done. • Access and use specialized knowledge when necessary (e.g., the sciences or skilled trades) to get a job done. • Think and act logically by using the steps of the scientific method (i.e., identify problems, collect information, form opinions and draw conclusions).	• Identify personal job-related interests, strengths, options and opportunities. • Demonstrate personal values and ethics in the workplace (e.g., honesty, fairness, and respect for others). • Exercise a sense of responsibility. • Demonstrate self-control. • Show pride in one's work. • Be enthusiastic about the work to be done. • Follow written or verbal directions. • Learn new skills and ways of doing things. • Identify and suggest new ideas for getting a job done. • Be a leader or a follower depending upon what is necessary to get a job done.	• Identify with the goals, norms, values, customs and culture of the group. • Communicate with all members of a group. • Show sensitivity to the thoughts and opinions of others in a group. • Use a team approach to identify problems and devise solutions to get a job done. • Exercise "give and take" to achieve group results. • Function in changing work-settings and in changing groups. • Determine when to be a leader or a follower depending on what is necessary to get a job done. • Show sensitivity to the needs of women and ethnic and racial minorities. • Be loyal to a group.

(Adapted from Employability Skills Task Force, 1989, p. 2)

Table 6

New York Skills

Basic Skills

(1) Language Arts

Listening and Speaking

- for personal response
- for social interaction
- for information and understanding
- for critical analysis and evaluation

Reading for

- aesthetic and personal response
- acquisition, interpretation, and application of information
- critical analysis and evaluation

Writing for

- personal expression
- social interaction
- information and understanding
- critical analysis and evaluation

(2) Mathematics

Basic Operations
Logic
Probability
Statistics
Measurement
Algebra/Geometry

Expanded Basic Skills

(1) Reasoning
(2) Interpersonal
(3) Working as a Member of a Team
(4) Using Information Systems
(5) Setting Priorities
(6) Personal Work Skills and Behaviors
(7) Personal and Civic Responsibility
(8) Manual Dexterity

No precise theoretical or conceptual framework was offered to explain the discrete differences between skill levels; however, Table 7 lists the dimensions which underlie the general progression from skill level 1 to skill level 6. An extensive report was generated to provide examples for each level of skill for all of the basic and expanded basic skills. Appendix 2 includes the examples for each skill level with respect to interpersonal skills.

Table 7

Dimensions Underlying New York Skill Levels

Low	to	High
simple	→	complex
routine	→	variable
concrete	→	abstract
structured	→	unstructured
recall of knowledge	→	evaluation of knowledge
directed	→	independent
conventional	→	innovative

(New York State Education Department, 1990, p. 1)

Appendix 3 summarizes the results by showing the percentage of jobs which require competency at each skill level for each of the identified skills (Anderson Committee, no date). In general, the results were similar to those of the Michigan study in that interpersonal skills, working as a member of a team, and personal work skills and behavior were more highly valued than traditional skills taught in high schools.

NAS

In 1984 the National Academy of Sciences convened a panel of employers, labor union representatives, scholars and educators to examine the skills required of high school graduates who enter the workforce after graduation. The panel identified ten "Core Competencies" required of all workers, regardless of education or specialty (see Table 8). The panel summarized their results into three basic findings: (a) The major asset required in the workforce is the ability to learn new knowledge and skills to adapt to the rapidly changing workplace; (b) the Core Competencies are required at all levels in the workforce; and (c) positive attitude and sound work habits are especially valued by employers (NAS, 1984, p. xi).

Table 8

National Academy of Science Skills

Command of English Language

Reasoning and Problem Solving, including:

- Identify problems
- Consider and evaluate possible alternative solutions, weighing their risks and benefits
- Formulate and reach decisions logically
- Separate fact from opinion
- Adjust to unanticipated situations by applying established rules and facts
- Work out new ways of handling recurring problems
- Determine what is needed to accomplish work assignments

Reading, including:

- Understand the purpose of written material
- Note details and facts
- Identify and summarize principal and subsidiary ideas
- Be aware of inconsistency in written material
- Verify information and evaluate the worth and objectivity of sources
- Interpret quantitative information; for example, in tables, charts, and graphs

Writing, including:

- Gather information suitable for the purpose
- Organize information in a logical and coherent manner
- Use standard English syntax
- Apply the rules of correct spelling, punctuation, and capitalization
- Attribute references correctly
- Use reference books such as a dictionary, a thesaurus, and an encyclopedia
- Write legibly

Computation, including:

- Add, subtract, multiply, and divide whole numbers, decimals, and fractions accurately
- Calculate distance, weight, area, volume, and time
- Convert from one measurement system to another, for example, from English to metric
- Determine the costs, time, or resources necessary for a task
- Calculate simple interest
- Compute costs and make change
- Understand simple probability and statistics
- Calculate using information obtained from charts, graphs, and tables
- Use ratios, proportions, percentages, and algebraic equations with a single unknown
- Estimate results and judge their accuracy

Table 8 (continued)

Science and Technology

Oral Communication, including:

- Communicate in standard English
- Understand the intent and details of oral communications
- Understand and give instructions
- Identify and summarize correctly principal and subsidiary ideas in discussions
- Obtain, clarify, and verify information through questioning
- Participate effectively in discussions

Interpersonal Relationships, including:

- Interact in a socially appropriate manner
- Demonstrate respect for the opinions, customs and individual differences of others
- Appreciate the importance and value of humor
- Offer and accept criticism constructively
- Handle conflict maturely
- Participate in reaching group decisions

Social and Economic Studies, including:

- The history of present-day American society
- The political, economic, and social systems of the United States and other countries
- The fundamentals of economics, including a basic understanding of the roles of money, capital investment, product pricing, cost, profit, and productivity, and market forces such as supply and demand
- The concept of "trade-offs" and the differences between economic principles, facts, and value judgments
- The forms and functions of local, state, and federal governments
- The rights and responsibilities of citizens
- Civil rights and justice in a free society

Personal Work Habits, including:

- A realistic, positive attitude toward one's self
- A positive attitude toward work and pride in accomplishment
- A willingness to learn
- Self-discipline, including regular and punctual attendance and dependability
- The ability to set goals and allocate time to achieve them
- The capacity to accept responsibility
- The ability to work with or without supervision
- Appropriate dress and grooming
- An understanding of the need for organization, supervision, rules, policies and procedures
- Freedom from substance abuse
- Appropriate personal hygiene

(Adapted from NAS, 1984, pp. 20-22, 24-27)

Summary

Several commonalities in the findings of the five studies are apparent. Specifically, four major categories of job-readiness skills can be seen running through the five frameworks. First, each study identified the need for basic academic skills. As seen in Table 9, these include the three R's as well as speaking and listening skills. Study participants judged job-related speaking and listening skills to be particularly important in both the Michigan and New York studies. Of the four common categories found, this one exhibited the greatest similarity across studies. This is not surprising, given that the basic skills have received the most attention and elaboration in the past.

Table 9

Major Skill Category 1: Basic Skills

SCANS	ASTD	Michigan	New York	NAS
Basic Skills Foundation Reading Writing Arithmetic/ Mathematics Listening Speaking	Basic Competency Skills Reading Writing Computation Communication Skills Speaking Listening	Academic Skills (see Table 5)	Basic Skills - Language Arts Listening and Speaking Reading Writing - Mathematics	Reading Writing Computation Oral Communication

Second, all studies identified the need for higher-order thinking skills, as seen in Table 10. In general, these skills were deemed necessary because of the rapidity of change in the workforce. The most common higher-order thinking skills identified can be seen as skills in adapting to these changes. Although the New York framework includes reasoning as an expanded basic skill, it clearly did not identify higher-order thinking skills to the extent that the other studies did. In the SCANS, ASTD, Michigan and NAS studies, problem-solving skills were identified as important higher-order thinking skills. Creativity also emerged in one form or another in those studies,

Table 10

Major Skill Category 2: Higher-Order Thinking Skills

SCANS	ASTD	Michigan	New York	NAS
Thinking Skills Foundation Creative Thinking Decision Making Problem Solving Seeing Things in Mind's Eye Knowing How to Learn Reasoning	The Foundation Learning How to Learn Adaptability Skills Problem Solving Thinking Creatively	Academic Skills Including: Understand and solve problems involving basic arithmetic and use the results Personal Management Skills Including: Identify and suggest new ideas for getting a job done	Reasoning The ability to draw conclusions through the use of rational processes	Reasoning and Problem-Solving Identify problems Consider alternative solutions Formulate and reach decisions logically Separate fact from opinion Adjust to unanticipated situations by applying established rules and facts Work out new ways of handling recurring problems Determine what is needed to accomplish work assignment

although the skill was not always referred to as "creativity" per se. Decision making was also identified as an important higher-order thinking skill in the SCANS, Michigan, New York, and NAS studies, but not in the ASTD study. In the SCANS and ASTD studies, learning how to learn was identified as an important higher-order thinking skill. Indeed, for the ASTD study, it was identified as *the* foundation skill. The ability to learn was also identified as one

of the three basic findings in the NAS study, although it is not identified in the framework of Core Competencies. The Michigan study also identified the need to learn new skills, but did not identify the ability to learn new skills as a job-readiness skill itself.

Third, within all five frameworks interpersonal and teamwork skills were judged to be essential, as indicated in Table 11. These skills have become important, the studies emphasize, because as responsibility is shifted further down the management hierarchy to groups of workers, the average worker needs to communicate and cooperate with other members of the organization to an increasing degree. Relative to the other major categories of skills identified, this category was identified as being especially important. On average, employers in the Michigan survey rated skills in working in groups and working with others between the "Critical" and "Highly Needed" points on the response scale. In the New York study, 84% of the jobs investigated were judged to require interpersonal skills at level 3 or higher, and 79% required team work skills at these levels (see Appendix 3).

Although all five studies identified interpersonal and team work skills and emphasized their importance, this category exhibited the greatest diversity in terms of the specific subskills which constitute it. It would seem that, at least at this point, these skills, although uniformly recognized as critical, are the most difficult to define and identify. Despite the differences, three common sets of subskills are apparent.

The single set of subskills in the interpersonal and teamwork skills category that all five studies identified were negotiation/conflict-resolution skills. Again, however, there was some diversity between the studies in how these skills were defined. The SCANS study defined negotiation skills as the ability to work toward agreements involving exchange of resources and resolution of divergent interests (see Table 2). ASTD reviewed definitions of negotiation skills found in the negotiation literature and emphasized the "principled" negotiation skills identified by Fisher and Ury (1981) (see Carnevale et al., 1990, pp. 330-350). The Michigan study operationalized negotiation skills simply as willingness to compromise (Mehrens, 1989, November, p. 10). Compromise is viewed quite differently in the negotiation literature from the notion of "resolving divergent interests" identified by

Table 11

Major Skill Category 3: Interpersonal and Teamwork Skills

SCANS	ASTD	Michigan	New York	NAS
Interpersonal Competency Participates as Member of a Team Teaches Others New Skills Serves Clients/ Customers Exercises Leadership Negotiates Works with Diversity	Group Effectiveness Skills Interpersonal Skills Teamwork Negotiation Influencing Skills Understanding Organizational Culture Sharing Leadership	Teamwork Skills (see Table 5)	Interpersonal The ability to interact effectively, professionally and socially Working as a Member of a Team The ability to conduct oneself according to the expressed or unexpressed norms of a group and to participate according to one's talents	Interpersonal Relationships Interact in socially appropriate manner Demonstrate respect for the opinions, customs, and individual differences of others Appreciate the importance and value of humor Offer and accept criticism constructively Handle conflict maturely Participate in reaching group decisions

SCANS (see O'Neil et al., 1992, for a summary). The NAS study does not define negotiation/conflict-resolution skills except to state that it is necessary for workers to realize that conflict is inherent but can be handled through "constructive means" (NAS, 1984, p. 25). In the New York study, although negotiation and conflict resolution skills are not explicitly identified within the definition of interpersonal and team work skills, several aspects of conflict resolution skills are virtually the only examples of interpersonal skills offered for levels 5 and 6 of the interpersonal skills (New York State Education Department, 1990, pp. 45-46).

Second, leadership skills were identified as a category of interpersonal and teamwork skills in three studies. The SCANS, ASTD and Michigan studies identified leadership skills as important, but again, there was substantial diversity in *how* these skills were defined and identified. The SCANS study spoke of persuasion (see Table 2). The ASTD study emphasized the skill of sharing leadership (see Table 4) and reviewed a number of current theories of leadership (Carnevale et al., 1990, pp. 377-398). The Michigan study emphasized the skill of recognizing when to be a leader and when to be a follower (see Table 5).

Third, the ability to work with others from diverse backgrounds was a category of interpersonal and teamwork skills identified by several studies. The SCANS, Michigan, New York, and NAS studies identified skills in being sensitive and responsive to the ethnic, cultural and gender differences that exist between workers.

The fourth major category of workforce competency common to the five reviewed studies focused on personal characteristics and attitudes rather than particular skills. As seen in Table 12, the important themes in this category were self-esteem, motivation, and responsibility. These types of worker qualities were generally rated as more critical than workforce "skills" in the Michigan survey. Eighty-four percent of the jobs investigated in the New York study were judged to require the personal work skills and behaviors at level 3 or higher (see Appendix 3).

Identified Skills and the CRESST Prototypes

The two CRESST prototype assessment approaches relate to the first three major categories of skills found in the five studies and do not directly assess the personal characteristics and attitudes category. The problem-solving skills prototype assessments are measures of both the mathematics skills identified in the basic skills category and the problem-solving skills identified in the higher-order thinking-skills category. The negotiation/conflict resolution prototype is a measure of the problem-solving and creativity skills identified as part of the higher-order thinking-skills category and the negotiation skills identified as part of the teamwork/interpersonal skills category. The two CRESST prototypes first will be described in greater detail, and then their precise relationship within each of the five frameworks will be discussed.

Table 12

Major Skill Category 4: Personal Characteristics and Attitudes

SCANS	ASTD	Michigan	New York	NAS
Personal Qualities Foundation Responsibility Self-Esteem Sociability Self-Management Integrity/ Honesty	Developmental Skills Self-Esteem Motivation and Goal-Setting Career Development (Planning)	Personal Management Skills (see Table 5)	Personal Work Skills and Behavior Personal and Civic Responsibility	Personal Work Habits (see Table 8)

Problem-Solving Prototype

Researchers have examined the cognitive indicators of skill in problem solving. The CRESST prototypes draw upon the work of Sternberg (1986) and Mayer, Tajika, and Stanley (1991), who have examined the indicators of problem-solving skills in mathematics in particular. Both Sternberg and Mayer et al. emphasize that skill in problem-solving is indicated by the ability to identify relevant information, distinguish it from irrelevant information, and then integrate it to solve the problem at hand. Two sample test items for these problem-solving skills are presented in Tables 13 and 14.

Table 13

Test Item for Integration Process

Lucia had $3.00 for lunch. She bought a sandwich for $.95, an apple for $.20, and a milk for $.45. How much money did she spend?

a. 3.00, .95, .20, .45

b. .95, .20, .45

c. .95, .45

d. 3

(Answer: b)

(Adapted from Mayer, Tajika, & Stanley, 1991)

Table 14

Test Item for Selective Combination

David is a cook in a small restaurant named "Lester's" which specializes in steaks. The restaurant has recently become so popular that the average wait to be seated is one hour. Mr. Lester has therefore asked David to reduce the amount of time needed to cook an order of six steaks to under one hour. The restaurant has a small grill just big enough to broil four steaks at a time. David says to himself, "It takes 30 minutes to broil both sides of one steak because each side takes 15 minutes. Since I can cook four steaks at the same time, 30 minutes will be enough to get four steaks ready. It will take another 30 minutes to cook the remaining two steaks which means a total of one hour." How can David complete cooking all six steaks in just 45 minutes?

Answer:

If one combines the information that there are six steaks that take 15 minutes per side to broil, in other words 12 sides to be broiled for 15 minutes, with the information that four steaks can be broiled at the same time, one can see that if four steaks are always on the grill, it will take only 45 minutes to grill all six. Assuming the six steaks are grouped into three pairs labeled A, B, and C, David can accomplish keeping four steaks on the grill by first broiling one side of the two A and two B steaks, taking off the B steaks and broiling side 2 of the A steaks and side 1 of the C steaks, and then broiling side 2 of the B and C steaks.

(Adapted from Sternberg, 1986)

Conflict Resolution Prototype

One of the important skills within the interpersonal/teamwork skills category is negotiation skills. A large body of research indicates that skills referred to as "integrative negotiation skills" lead to more mutually satisfying resolutions and better relations between the parties to the conflict (Brett, Goldberg, & Ury, 1990; Pruitt & Syna, 1983; Tjosvold, 1990; Womack, 1990). According to this research, the indicators of effective negotiation skills are: (a) the ability to identify and articulate the common goals and interdependency of the parties; (b) the ability to effectively communicate the basis for one's own position as well as to understand and appreciate the other party's position(s); and (c) the ability to integrate the information gained to generate creative solutions.

Based on this research, CRESST has developed sample test items for negotiation skills. Drawing upon a workforce scenario (see Table 15) described in the SCANS report (SCANS, 1991, pp. 9-10), sample test items were developed

Table 15

Workforce Scenario

Greg, Anthony, and Kathleen have just embarked upon their entrepreneurial dream—opening their own restaurant (The Three Chefs) in a growing southern town. Each of them independently worked hard to get to this point, spending 10 or more years learning the ropes in the restaurant business, pooling their savings, and borrowing from friends and family to get the start-up capital they needed.

Greg has worked in the restaurant business the longest and has been wanting to start his own restaurant for several years so he could be his own boss and enjoy the benefits of his own labor. Greg has managed several restaurants and enjoys using his business skills to make restaurants a successful business endeavor. Greg put up 10% more start-up cash than Anthony and Kathleen and also took out a second mortgage on his home to satisfy the local bank's demand for security for operating credit. He serves as manager and "front-of-the-house" shift supervisor during the day.

Anthony loves to combine his creative talent with the skills he gained at a culinary arts school he attended in the Northeast to produce unique and delicious gourmet delights. Anthony trains the staff, does the bookkeeping, and prepares the evening meals, which he loves the most.

Kathleen has always enjoyed the restaurant business for the service it provides of offering a pleasant environment in which family and friends can enjoy a meal together. Kathleen majored in interior design in college and enjoys using the skills she gained to improve the ambiance of a restaurant. Even when not working, Kathleen enjoys going out with friends and family to a restaurant. She is the lunchtime chef and evening manager.

(Adapted from SCANS, 1991, pp. 9-10)

(see Table 16). The SCANS report describes three friends' endeavor to open their own restaurant to portray the Commission-identified competencies in the accommodations and food services sector of the economy. Expanding on each person's background and responsibilities described in the SCANS scenario, our modified version below indicates how those differences in background and responsibilities led to divergent interests with regard to suggestions for improving the restaurant. In three different questions, students are asked to perform one of the three cognitive indicators.

Table 16

Sample Test Items

Item 1: Articulate Common Goals

Write a short essay explaining the goal(s) which Greg, Anthony, and Kathleen have in common. Also explain the ways in which they need each other to accomplish their goals.

Item 2: Understand Others' Positions

The Three Chefs has been in business for one month. It has been moderately busy in that time. During the month, each partner has formed ideas and opinions about how to improve The Three Chefs. They have come together on Monday morning to discuss their various ideas. They have agreed that they will meet weekly at this time for 45 minutes to discuss the business. They have also agreed that they will take turns chairing the meeting, and it was decided that Greg would chair the first meeting.

Greg calls first on Anthony, who is hardly able to restrain his enthusiasm to express his suggestions. Anthony begins by telling Kathleen and Greg about a new commercial food processor he learned of through one of his old classmates at the culinary arts school. As Anthony explains different features of the processor, he comments on all the wonderful dishes he could prepare with it. He believes that the expense of the equipment, which is considerable, will be offset by the volume of business they will do by offering such wonderful food and by being able to charge more for it. He therefore suggests that they purchase the food processor. His discussion of possible new dishes they could offer leads him to a discussion of his other suggestion to order a wider variety of higher quality ingredients in order to serve the truly exquisite food he thinks they should offer.

After listening to Anthony's suggestions, Greg asks Kathleen to share her suggestions. Kathleen says she has received a few comments from their evening customers that The Three Chefs' decor is somewhat barren. Not wanting to expend too much capital without having a sense of how good their business was going to be, the three had decided to initially buy only the essentials for the restaurant's decor. Kathleen suggests that, since they have had an encouraging first month, they should invest in decorating The Three Chefs and offers her ideas of some of the improvements that could be made. Otherwise, she argues, people won't enjoy eating out at The Three Chefs and won't come back.

Pretend that you are Greg. Anthony and Kathleen have expressed their suggestions as described above. It is now your turn, but the 45 minutes allocated for the meeting have been taken up. Knowing that everyone has important preparations to make for the coming day, you suggest that you will write a summary of Anthony's and Kathleen's suggestions as well as your own suggestions rather than explaining them now. It is agreed that you will give this summary to Anthony and Kathleen to read before next Monday when the three of you will continue the discussion. As Greg, write such a summary. You should identify Anthony's and Kathleen's suggestions along with the reasons they offered to support those suggestions. You should try to represent Kathleen's and Anthony's positions as fairly as possible, while also representing Greg's position, as if you were Greg. In representing Greg's position, you should keep the following concerns in mind.

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Table 16 (continued)

First, given that you put up 10% more start-up capital than the others and took out a second mortgage on your home to secure operating credit with the bank, you are quite concerned that costs at The Three Chefs be held to a minimum and profits maximized. Anthony's and Kathleen's suggestions, all of which sound as though they will involve considerable cash outlays, therefore concern you. Second, you have a couple of your own suggestions which correspond to your concerns. You have noticed that many of the lunchtime customers are in a hurry. On several occasions you heard customers commenting that they wished the food would be served more promptly so they wouldn't go over their lunch break. You also observed that between 12:00 and 1:00 it was often quite busy and that customers had sometimes waited for 20 minutes to be seated. Your idea, therefore, is to offer a menu with items that are quicker to prepare to better serve the customers. Furthermore, such a change would allow The Three Chefs to do a higher volume of business and therefore increase profits.

Write a short essay that summarizes everyone's position.

Item 3: Generation of Creative Solutions

With the information given in item 2, devise a compromise which takes into account Greg's, Anthony's, and Kathleen's mutual and individual concerns and suggestions. Your goal should be to devise a compromise which best incorporates the information provided by the three parties and which best and most fairly accommodates each of their positions. Write an essay describing that compromise and how it takes into account the concerns and issues raised.

Relationship to SCANS Skills

The problem-solving prototype serves as a measure of the Basic and Thinking Skills foundations combined with the Information Management Competency identified within the SCANS framework. Specifically, these test items measure the Problem-Solving subskill of the Thinking Skills foundation, the Arithmetic and Mathematics subskills of the Basic Skills foundation, and the "Interpreting and Communicating Data" aspect of the Information Management Competency (see Table 17).

Table 17

The Problem-Solving Prototype and the SCANS Skills

	INFORMATION MANAGEMENT COMPETENCY			
THINKING SKILLS FOUNDATION	Acquiring & Evaluating Information	Organizing & Maintaining Information	Interpreting & Communicating Information	Using Computers
Thinking Creatively				
Making Decisions				
Solving Problems			X	
Seeing Things in Mind's Eye				
Knowing How to Learn				
Reasoning				
BASIC SKILLS FOUNDATION				
Reading				
Writing				
Arithmetic/ Mathematics			X	
Listening				
Speaking				

The negotiation skills prototype serves as a measure of the Negotiation subskill of the Interpersonal Competency combined with the Thinking Creatively, Making Decisions, and Solving Problems subskills of the Thinking Skills foundation (see Table 18).

Table 18

The Negotiation Prototype and the SCANS Skills

	INTERPERSONAL COMPETENCY					
THINKING SKILLS FOUNDATION	Working on Teams	Teaching Others	Serving Customers	Leading	Negotiating	Working with Cultural Diversity
Thinking Creatively					X	
Making Decisions					X	
Solving Problems					X	
Seeing Things in Mind's Eye						
Knowing How to Learn						
Reasoning						

Relationship to ASTD Skills

In terms of the ASTD skills framework, the problem-solving test prototype measures the Problem-Solving skill within the Adaptability Skills group along with the Computation skill identified as part of the Basic Competency Skills group (see Table 19).

Table 19

The Problem-Solving Prototype and the ASTD Skills

	ADAPTABILITY SKILLS	
BASIC COMPETENCY SKILLS	Problem Solving	Thinking Creatively
Reading		
Writing		
Computation	X	

The negotiation skills test prototype measures the Negotiation skill identified as part of the Group Effectiveness Skills group combined with the Problem Solving skills and Creative Thinking skills which make up the Adaptability Skills group (see Table 20).

Table 20

The Negotiation Prototype and the ASTD Skills

	GROUP EFFECTIVENESS SKILLS		
ADAPTABILITY SKILLS	Interpersonal Skills	Teamwork	Negotiation
Problem Solving			X
Thinking Creatively			X

Relationship to Michigan Skills

Relative to the refined Michigan list of 86 subskills, the problem-solving test prototype measures the Combine Useful Information, Basic Calculations, Recognize and Define Problems, Determine Source Problems, New Problem Solving, and Select Best Solution skills within the Academic Skills category. The negotiation skills prototype measures several of the same problem-solving skills identified in the Academic Skills category. Specifically, the Combine

Useful Information, New Problem Solving, and Select Best Solution skills are measured. The negotiation skills prototype also measures several skills from the Teamwork Skills category. Specifically, they are the Use Team Approach to Problems, Communicate with Team, Compromise, Sensitivity to Thoughts of Others, and Cooperate With Others skills (Mehrens, 1989, pp. 9-10).

Relationship with New York Skills

The problem-solving prototype measures the Basic Operations and Logic subskills of the Mathematics Basic Skills as well as the Reasoning Expanded Basic Skill. The negotiation prototype measures the Interpersonal Skills and Reasoning Expanded Basic Skills (see Table 6).

Relationship with NAS Skills

The problem-solving prototype measures the Identifying Problems, Consider and Evaluate Possible Alternative Solutions, Formulate and Reach Decisions Logically, and Adjust to Unanticipated Situations by Applying Established Rules and Facts subskills of the Reasoning and Problem-Solving Core Competency. The problem-solving prototype also measures the Add, Subtract, Multiply, and Divide Whole Numbers, Decimals, and Fractions Accurately, and the Determine Costs, Time or Resources Necessary for a Task subskills of the Computation Core Competency.

The negotiation skills prototype measures the Identify Problem, Consider and Evaluate Possible Alternative Solutions, Weighing Their Risks and Benefits, Formulate and Reach Decisions Logically, and Separate Fact From Opinion subskills of the Reasoning and Problem-Solving Core Competency. Also measured by the negotiation skills prototype is the Handle Group Decisions subskill of the Interpersonal Relationships Core Competency (see Table 8).

Where to Go Next?

This report documents that our prototype items have an excellent generalizability across various theoretical frameworks. A prior report (O'Neil et al., 1992) provided a general methodology to generate prototypes for the assessment of workforce readiness competencies. Next, we need to generate a series of assessment measures and document their reliability and validity as

measures of workforce readiness. In addition, various technological approaches should be explored for administering, scoring and interpreting these measures.

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Appendix 1

Basic Skills Definitions*

* From Anderson Committee, *Report to the Board of Regents on Career Preparation Validation Study*, Appendix II, New York State Education Department, Albany, NY, no date.

Competency Definitions

The following definitions were used by the observers/interviewers in applying the scales to the entry-level jobs.

BASICS

Language Arts

Reading for Aesthetic and Personal Response

The ability to enjoy and appreciate texts, relate texts to self, and respond sensitively to texts with diverse social, historical, and cultural dimensions.

Reading for Acquisition, Interpretation, and Application of Information

The ability to collect data, facts, or ideas, discover relationships, concepts, or generalizations, and use knowledge generated from text.

Reading for Critical Analysis and Evaluation

The ability to use personal and/or objective criteria to form opinions or make judgments about ideas and information in written texts.

Writing for Personal Expression

The ability to use all forms of writing to investigate and express personal feelings, attitudes, and ideas.

Writing for Social Interaction

The ability to use all forms of writing to communicate in everyday personal situations.

Writing for Information and Understanding

The ability to interpret, apply, and transmit information in writing.

Writing for Critical Analysis and Evaluation

The ability to use personal or objective criteria to express opinions and make judgments in writing about issues, ideas, and experiences.

Listening and Speaking for Personal Response

The ability to enjoy and appreciate oral presentations and use oral language to express self and to entertain.

Listening and Speaking for Social Interaction

The ability to communicate through spoken language in everyday interpersonal situations.

Listening and Speaking for Information and Understanding

The ability to acquire, interpret, apply, and transmit information through oral language.

Listening and Speaking for Critical Analysis and Evaluation

The ability to evaluate and generate information and ideas according to personal and/or objective criteria.

Mathematics

Basic Operations

The ability to perform basic operations of mathematics.

Logic

The ability to use reasoning to determine relationships among propositions in terms of implication, contradiction, contrariety, and conversion.

Probability

The ability to predict the number of times something will probably occur over the range of possible occurrences.

Statistics

The ability to assemble, classify, tabulate, and analyze numerical facts or data.

Measurement

The ability to determine size, extent, and quantity using standard and metric systems.

Algebra/Geometry

Algebra is the ability to use and solve formulas and equations, to interpret and use tables, charts, graphs and equations, and to solve problems using algebraic techniques. Geometry is the ability to describe, compare, and classify geometric figures, and to apply geometric properties and formulas.

Manual Dexterity

The ability to apply psychomotor, cognitive, and affective skills in the execution of manipulative activities.

Reasoning

The ability to draw conclusions through the use of rational processes.

Interpersonal Skills

The ability to interact effectively professionally and socially.

Working as a Member of a Team

The ability to conduct oneself according to the expressed or unexpressed norms of a group and to participate according to one's talents.

Using Information Systems

The ability to gather, manipulate, retrieve, analyze, and synthesize data.

Setting Priorities

The ability to make judgments regarding relative criticality of tasks in order to accomplish objectives and/or meet deadlines.

Personal Work Skills and Behaviors

The ability to apply one's efforts systematically and conscientiously to required tasks.

Personal and Civic Responsibility

Accountability for one's actions and fulfillment of one's duties as a citizen.

Appendix 2

Skill Level Examples for Interpersonal Skills*

* From New York State Education Department, *Basic and Expanded Basic Skills. Scales for Validation Study*, pp. 45-46, Albany, NY, July 1990.

Interpersonal Skills

The ability to interact effectively professionally and socially.

Descriptors

1. • tolerates others
   • refrains from causing conflict when faced with potentially difficult interactions
2. • conducts oneself with courtesy and tact
   • provides positive feedback to others
3. • recognizes and handles own routine interpersonal problems while respecting cultural, gender, and ethnic diversity
4. • is empathetic when providing negative criticism
   • reacts constructively to positive and negative criticism
   • diffuses anxiety in others when dealing with controversial information or unsettling events
5. • is sought out often by others for advice in interpersonal conflict situations
   • uses a variety of approaches for handling conflict
   • deals with personal conflicts objectively
6. • helps others to resolve interpersonal differences
   • fosters an atmosphere of harmony among individuals
   • serves as a role model in formal and informal interactions

Appendix 3

Summary of Validation Results*

* From Anderson Committee, *Report to the Board of Regents on Career Preparation Validation Study*, Appendix V, Albany, NY, no date.

Summary of Validation Data; Sample of Employee Observations/Interviews*

Competency Scale	Percent of Jobs at Competency Level						
	N/A	One	Two	Three	Four	Five	Six
Reading for Personal Response	71%	8%	9%	6%	4%	2%	0%
Reading for Information	4%	5%	13%	27%	30%	17%	5%
Reading for Critical Analysis and Evaluation	20%	6%	10%	24%	26%	12%	3%
Writing for Personal Expression	66%	11%	9%	8%	3%	2%	0%
Writing for Social Interaction	48%	17%	15%	10%	7%	2%	1%
Writing for Information	7%	13%	27%	25%	16%	8%	3%
Writing for Critical Analysis and Evaluation	26%	11%	22%	21%	12%	7%	2%
Listening/Speaking Personal Response	40%	7%	19%	16%	9%	7%	2%
Listening/Speaking Social Interaction	12%	6%	25%	28%	17%	8%	4%
Listening/Speaking for Information	1%	4%	14%	25%	33%	16%	7%
Listening/Speaking for Critical Analysis and Evaluation	8%	8%	18%	23%	28%	11%	3%
Math – Basic Operations	4%	10%	13%	25%	26%	11%	12%
Math – Logic	7%	10%	15%	28%	24%	10%	6%
Math – Probability	22%	19%	12%	23%	17%	6%	2%
Math – Statistics	46%	16%	12%	11%	6%	5%	3%
Math – Measurement	21%	7%	10%	17%	23%	14%	9%
Math – Algebra and Geometry	78%	7%	5%	2%	2%	4%	2%
Manual Dexterity	1%	3%	17%	30%	24%	21%	4%
Reasoning	1%	5%	11%	19%	32%	28%	5%
Interpersonal Skills	1%	3%	12%	21%	27%	20%	16%
Working as Member of Team	1%	9%	11%	21%	22%	23%	13%
Using Information Systems	22%	10%	16%	18%	15%	15%	5%
Setting Priorities	4%	6%	15%	20%	27%	20%	9%
Personal Work Skills and Behaviors	1%	7%	9%	18%	27%	25%	14%
Personal and Civil Responsibility	20%	25%	7%	7%	19%	16%	6%

* From Anderson Committee, *Report to the Board of Regents on Career Preparation Validation Study*, Appendix V, New York State Education Department, Albany, NY, no date.